Le Havre – Port 2000: a move towards the environmental restoration of the Seine Estuary: Part 2

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Part 1 of this article introduced us to the reasons behind the environmental restoration of the Seine Estuary and detailed the restoration of the mudflats. Part 2 will focus on the creation of a resting islet in the Seine River, for sea birds, south of the Estuary, and then conclude with the port works and follow-up studies, carried out during the works.

Creation of a rest place in the River Seine: M€ 9

Design

Ornithologists wished to produce two or three sites with a minimum surface of about 1,000m^2 so that differentiated management types of the areas could be carried out according to the species and to avoid a particularly dominating species colonising the others, which would be contrary to the development purpose of the bio-diversity.

In order to more precisely define this development, a working session was held in 2000, grouping together a representative of the Groupe Ornithologique Normand (Normandy Ornithological Society), a member of the Maison de l'Estuaire (Estuary House), the manager of the Nature Reserve of the Seine Estuary, the Directions Régionales de l'Environnement de Haute et Basse Normandie, DIREN (Environmental Regional Divisions of Lower and Upper-Normandy) and engineers from the Port Autonome de Rouen and Port Autonome du Havre. Each participant explained their objectives and obligations, and the design progression followed the stages stated in Figure 1. In order to meet the ornithological objectives, the initial basic scheme was made up of three islets, which were totally independent from one another (Figure 1.a).

Given the severe hydrodynamic conditions (waves and currents) which can happen at the entry to the Seine Estuary and in order to reduce the costs of the islet protection systems, it appeared to be adequate to consider the idea that the largest islet, that is the westernmost, could serve as a protection structure for the other two. This principle led us to think of a design schematically representing two V-shapes and one circle, in which the biggest islet was sheltering that of an average size and the latter serving as a protection for the smaller one (Figure 1.b).

As things progressed, it rapidly appeared that it would be shrewder to make the two smaller islets head to foot so that:

- On the one hand, the average distance between the two be increased, which reduces the trouble between species.
- And, on the other hand, a relatively sheltered surface be created between them, thus favouring the deposit of fine materials, such as silt and mud, likely to contain organisms which could contribute to feeding birds (Figure 1.c).

Taking the idea of creating favourable zones to feed birds even further, a low-height breakwater was also considered, which could connect the North of the Western islet with the Eastern zone of this construction, thus favouring the deposit of mud in the area defined (Figure 1.d).

It is with this basic principle scheme in mind that the meeting ended, giving the Port Autonome du Havre the responsibility of translating it into a structure, which could not be finalised without carrying out a phase of studies, including model studies that made it possible to improve the design, both in regards to the purely technical point-of-view and in regards to the environmental purposes looked for.

Creation of the islet

After international tendering, the Atlantique Dragage Company, a French subsidiary of the boskalis group, was awarded the public contract for the construction.

The body of the islet was made up of sand and gravel materials (260,000 m^3 coming from dredging operations for port works), protected on the most exposed parts by a protection armour of 200 to 250 kg hard rock-fills. In all, around 57,000 t. of hard rock-fills and 545,000 t. of sand and gravel were put in place during the period between October 2004 to April 2005.

The inner bay of the islet (east of the western part, south of the junction breakwater, west of the eastern part) as well as the south side of the eastern part are not protected, which make it possible,

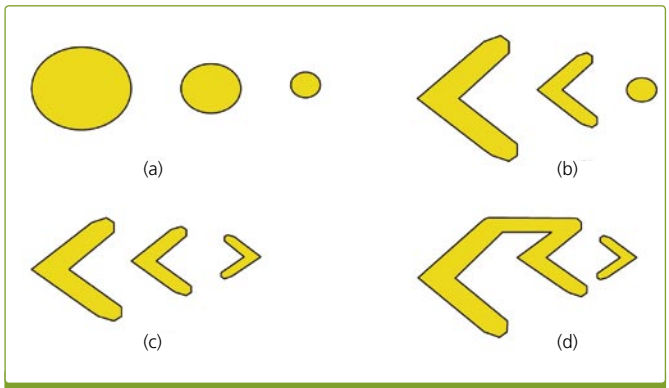

Figure 1. Design progression of the islets.

Figure 2. Islet at low tide South-East view, 14 months after completion of work.

in the course of time to benefit from the natural changes through the effects of the sea.

With its numerous curves, its embankments with different slopes, its rather small surface (200 x 325 m) and its geographic location, the construction of the rest place was a real challenge for the Atlantique Dragages staff.

Since the work site was only accessible by sea (from the mid-tide owing to the admissible draught on site), great attention had to be paid to the work schedule as all logistics (transport, staff changes, tipping operations, topography) was totally dependent of tides.

The work was completed in mid-April 2005, according to the work schedule. Owing to the different levels per zone, the islet finally presents three ground areas separated at high-coefficient high tide. These areas can accommodate different sea bird species. The islet has two stretches of water: a bay open to the south (the inner bay) and a lagoon centred in the eastern part, protected by rock-fills on three sides, which fills up during the highest tides, and then, empties gradually owing to the draining effect of the underlying sand.

Access to this islet is, of course, forbidden to all except ornithologists who occasionally come to carry out their follow-up studies ashore.

It should be stressed that the first counts, carried out as early as the weeks following the end of works, showed high frequency by sea birds, thus confirming the validity of this approach.

Conclusion

One of the major technical difficulties in Port 2000 will have been the completion of the port works and the environmental works at the same time, all having to be studied, selected and implemented to limit the impact of the port works on the estuary environment and on sedimentology as much as possible.

The preliminary studies had largely proven the scheduling of maritime works was of prime importance for the possible changes in the estuary sedimentology (during and even after the works). Thus, the phasing selected for the completion of the breakwaters was studied by the selected group DPAM 2000 (specifically GTM Terrassement and Dredging International were in charge of dredging works). To minimise the effects of construction works on the estuary environment, the works were completed by the dredging of a trench (3.5 Mm^3) south of the structures.

Likewise, the structures were designed with the objective of re-using the maximum amount of dredged materials by looking classically for a balance between earthmoving/back-fills on the whole site (out of 60 Mm^3, only half was deposited at sea), but also by re-using the sand and gravel materials in the substructure and in the body of the breakwaters, or by creating a beach at the foot of the structures or even by building an ecological beach on which species of protected maritime plants were transferred to replace an inner breakwater. The dredged materials thus re-used

Figure 3. Construction site of the islet: placing of sand and gravel materials inside the rock-fill cordon.

in the structures account for a volume of 15 Mm^3 to which all volumes used as back-fills in back-up areas must be added.

As all related works carried out during the construction of Port 2000 terminals aim at favouring bio-diversity in the Seine Estuary, positive and concrete effects on the different types of environment, the estuary flora and fauna, are expected in the short and longer term.

To secure this result, in liaison with the scientists working in the Seine Estuary, an important programme of scientific monitoring of the areas and domains potentially affected by Port 2000 was created. Its implementation by the PAH began between 2000 and 2002, according to the subject matters followed, and is due to continue until 2010. It specifically includes studies on:

- The biological resources by more precisely observing birds, benthic, supra-benthic populations, as well as fish and shellfish.
- The changes in depths both in regards to morphology, with a monitoring of the areas of deposit of sediments or eroding areas, and granulometry, due to the fact that the kinds of sediment have an impact on the nature of living organisms which settle there and are an important link in the different biological chains existing in the estuary.

The study of avifauna has shown a change in the breakdown of bird species in the estuary since 2000 and specifically a decrease in the population of the site by limicolous, whereas the anatidae family is increasing. The morphological and granulometric changes noted so far globally appear to be compliant with the results forecast by sedimentological studies. In addition, no significant change in the benthos or halieutic resources is noted.

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ABOUT THE ORGANISATION

Le Havre is the fifth biggest European port for tonnage, the biggest French port for external trade, and the biggest French port for containerised trade. With its wide range of port terminals, Le Havre can process every type of cargo, whether in liquid or dry bulk format, or general cargo (containers and ro-ro traffic) or dangerous goods.

Owing to its ideal geographic location at the head of the ports of the northwest seaboard of Europe, Le Havre is most often included in the round trips of large liner ships as the first European port of call on import or last port of call on export. As a deep-water seaport, Le Havre can accommodate the largest vessels (containerships with a capacity of more than 9,000 TEU, oil tankers up to 500,000 dwt). Accessible around the clock, seven days a week and all year through, the port of Le Havre offers fluid inland connections throughout western Europe, by waterway (feedering/short sea) and inland transport.

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